We claim:

1. A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a thermoelectric couple comprising:

(a) a sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement; and

(c) an electrically conductive member positioned on the flexible substrate and electrically connecting a first end of the p-type thermoelement with a second end of the n-type thermoelement.

2. The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements have L/A ratios greater than about 20 cm^{-1}.

3. The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements have L/A ratios greater than about 100 cm^{-1}.

4. The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements comprise Bi_aTe_b where a is about 2 and b is about 3.

5. The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements are selected from the group Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y alloys where x is about 2 and y is about 3.

6. The thermoelectric power source of claim 1 further comprising at least about 50 thermoelectric couples, wherein the thermoelectric power source has a power output of at least 1 μW with a voltage of at least at least 0.25 volt.

7. The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

8. The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 20 angstroms in thickness.

9. The thermoelectric power source of claim 1 further comprising at least about 1000 thermoelectric couples, wherein the thermoelectric power source has a power output of about 1W with a voltage of at least about 1 volt.

10. The thermoelectric power source of claim 1 wherein the p-type thermoelements have different widths as compared to the n-type thermoelements.

11. The thermoelectric power source of claim 1 wherein two or more p-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned p-type thermoelements are electrically connected in series to n-type thermoelements.

12. The thermoelectric power source of claim 1 further including multiple thermoelectric couples electrically connected in series on the upper surface of the flexible substrate and wherein the flexible substrate is in a coil configuration.

13. The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

14. The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and provides voltages of greater than about 1 volt.

15. The thermoelectric power source of claim 14 wherein the thermoelectric power source produces power at temperature differences of about 20°C or less.

16. The thermoelectric power source of claim 1 wherein two or more n-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned n-type thermoelements are electrically connected in series to p-type thermoelements.

17. The thermoelectric power source of claim 1 wherein the n-type thermoelements are substantially free of selenium.

18. The thermoelectric power source of claim 1 wherein the flexible substrate is a polyimide.

19. The thermoelectric power source of claim 1 wherein the p-type thermoelement is a superlattice.

20. The thermoelectric power source of claim 19 wherein the superlattice comprises alternating Bi_2Te_3 and Sb_2Te_3 layers with thicknesses between about 50 Å and about 150 Å.

21. The thermoelectric power source of claim 1 wherein the n-type thermoelement is a superlattice.

22. The thermoelectric power source of claim 21 wherein the superlattice comprises alternating Bi_2Te_3 and Sb_2Te_3 layers with thicknesses between about 50 Å and about 150 Å.

23. A thermoelectric power source comprising:

a flexible substrate having an upper surface;

multiple thermocouples electrically connected to one another on the upper surface of the flexible substrate, the thermocouples comprising:

sputter deposited thin film p-type thermoelements;

sputter deposited thin film n-type thermoelements alternatingly positioned adjacent the p-type thermoelements; and

wherein the thermoelectric power source has a volume of less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

24. The thermoelectric device of claim 23 wherein the multiple thermocouples electrically connected to one another in series or in series-parallel.

25. The thermoelectric power source of claim 23 wherein the p-type thermoelements have different widths as compared to the n-type thermoelements.

26. A method for fabricating thermoelectric power sources comprising:

providing a flexible substrate;

sputter depositing multiple thin films of n-type thermoelectric material onto the flexible substrate;

sputter depositing multiple thin films of p-type thermoelectric material onto the flexible substrate; and

forming multiple thermocouples on the flexible substrate by electrically connecting the thin films of p-type thermoelectric material to the thin films of n-type thermoelectric materials.

27. The method of claim 26 wherein the thermoelectric power source is fabricated to have a volume of less than about 10 cm^3 and to provide voltages of greater than about 1 volt.

28. The method of claim 26 wherein the p-type or the n-type thermoelements are sputter deposited to have L/A ratios greater than about 50 cm^{-1}.

29. The method of claim 26 wherein the p-type or the n-type thermoelement materials are sputter deposited to have L/A ratios greater than about 20 cm^{-1}.

30. The method of claim 26 the p-type or the n-type thermoelement materials sputter deposited to form thin films of Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y alloys where x is about 2 and y is about 3.

31. The method of claim 26 further comprising winding the flexible substrate into a coil configuration.

32. The method of claim 27 further comprising activating thermoelectric power source by a temperature gradient of about 20°C or less.

33. The method of claim 26 wherein targets used for sputter depositing a thin film of n-type or p-type thermoelectric material onto a flexible substrate comprise Sb_2Te_3 and Bi_2Te_3.

34. The method of claim 33 wherein an RF power of about 30 watts is supplied to the Sb_2Te_3 target and an RF power of about 10 watts is supplied to the Bi_2Te_3 target to sputter deposit the thin film of p-type thermoelectric material.

35. The method of claim 32 wherein an RF power of about 30 watts is supplied to the Sb_2Te_3 target and an RF power of about 20 watts is supplied to the Bi_2Te_3 target to sputter deposit the thin film of n-type thermoelectric material.

36. The method of claim 26 wherein a sputtering gas pressure is maintained at about 3 millitorr during the sputter deposition of the thin film of n-type thermoelectric material.

37 A method for providing electrical energy to an electrical device in an environment having a first and a second temperature region comprising the steps of:

providing a means for transmitting ambient energy collected in the first temperature region,

providing a thermoelectric device having a first side and a second side,

providing the means for transmitting the ambient energy collected in the first temperature region in communication with the first side of the thermoelectric device, and

providing the second side of the thermoelectric device in communication with the second temperature region.

38. The method of claim 38 wherein the thermoelectric device is selected from the group consisting of metallic wire thermocouples, discrete element semiconductors, and thin film semiconductors assembled in alternating p- and n-type arrays, and combinations thereof.

39. The method of claim 38 wherein the metallic wire thermocouples are selected from the group consisting of iron-constantan; copper-constantan; chromel-alumel; chromel-constantan; platinum-rhodium alloys and tungsten-rhenium alloys, and combinations thereof.

40. The method of claim 38 wherein the discrete element semiconductors assembled in alternating p- and n-type arrays are connected electrically in series, parallel, and in combinations thereof.

41. The method of claim 40 wherein the p-type arrays are selected from the group consisting of bismuth telluride, lead telluride, tin telluride, zinc antimonide, cerium-iron antimonide, silicon-germanium, and combinations thereof.

42. The method of claim 40 wherein the n-type arrays are selected from the group consisting of bismuth telluride, lead telluride; cobalt antimonide; silicon-germanium, and combinations thereof.

43. The method of claim 38 wherein the thin film semiconductors are selected as having p-type materials fabricated of bismuth telluride, lead telluride, tin telluride, zinc antimonide, cerium-iron antimonide, silicon-germanium, and combinations thereof sputter deposited as thin films on a substrate; and n-type semiconductors fabricated of bismuth telluride, lead telluride, cobalt antimonide, silicon-germanium and combinations thereof sputter deposited as thin films on a substrate.

44. The method of claim 43 wherein the thin film semiconductors are selected as bismuth telluride sputter deposited as thin films on a substrate.

45. The method of claim 37 further comprising the steps of providing a second means for transmitting ambient energy collected in the second temperature region in communication with the second side of the thermoelectric device and in communication with the second temperature region.

46. The method of claim 37 wherein the step of transmitting ambient energy is performed by means selected from collecting ambient energy, focusing ambient energy, transferring ambient energy, and combinations thereof.

47. The method of claim 46 wherein the step of transferring ambient energy is performed by means selected from convection, conduction, radiation, and combinations thereof.

48. The method of claim 37 wherein the temperature difference between the first temperature region and the second temperature region is between about -18°C and 38°C.

49. The method of claim 37 wherein the temperature difference between the first temperature region and the second temperature region is between about -18°C and 10°C.

50. An apparatus for generating electrical energy from an environment having a first temperature region and a second temperature region comprising a thermoelectric device having a first side and a second side wherein the first side is in communication with a means for transmitting ambient thermal energy collected in the first temperature region.

51. The apparatus of claim 50 wherein the thermoelectric device is selected from the group consisting of metallic wire thermocouples and discrete element semiconductors assembled in alternating p- and n-type arrays, and combinations thereof.

52. The apparatus of claim 51 wherein the metallic wire thermocouples are selected from the group consisting of iron-constantan; copper-constantan; chromel-

alumel; chromel-constantan; platinum-rhodium alloys and tungsten-rhenium alloys, and combinations thereof.

53. The apparatus of claim 51 wherein the discrete element semiconductors assembled in alternating p- and n-type arrays are connected electrically in series, parallel, and in combinations thereof.

54. The apparatus of claim 53 wherein the p-type arrays are selected from the group consisting of bismuth telluride, lead telluride, tin telluride, zinc antimonide, cerium-iron antimonide, silicon-germanium, and combinations thereof.

55. The apparatus of claim 54 wherein the n-type arrays are selected from the group consisting of bismuth telluride, lead telluride, cobalt antimonide; silicon-germanium, and combinations thereof.

56. The apparatus of claim 51 wherein the discrete element semiconductors are selected as thin film semiconductors of bismuth telluride sputter deposited as thin films on a substrate.

57. The apparatus of claim 50 further comprising a second means for transmitting ambient energy collected in the second temperature region in communication with the second side of the thermoelectric device.

58. The apparatus of claim 50 wherein the means for transmitting ambient energy is selected from an ambient energy collection means, an ambient energy focusing means, an ambient energy transmission means, and combinations thereof.

59. The apparatus of claim 58 wherein the ambient energy transferring means is selected from a convection means, a conduction means, a radiation means, and combinations thereof.

60. The apparatus of claim 50 further comprising a means for alternately storing and discharging electrical energy produced by the thermoelectric device.

61. The apparatus of claim 50 wherein the a means for alternately storing and discharging electrical energy produced by the thermoelectric device is selected from the group consisting of a battery, a capacitor, a supercapacitor, and combinations thereof.

62. The apparatus of claim 50 further comprising at least one sensor powered by electrical energy discharged from the means for alternately storing and discharging electrical energy produced by the thermoelectric device.

63. The apparatus of claim 62 further comprising at least one transmitter powered by electrical energy discharged from the means for alternately storing and discharging electrical energy produced by the thermoelectric device and capable of transmitting data gathered by the sensor.

64. The apparatus of claim 50 further comprising at least one voltage amplifiers for amplifying the voltage of electrical energy generated by the thermoelectric device.

65. The apparatus of claim 62 further comprising at least one microprocessor capable of processing the data gathered by at least one of the sensors.

66. The apparatus of claim 62 further comprising at least one data storage means capable of storing the data gathered by at least one of the sensors.

67. A thermoelectric power source comprising:

a thermoelectric module having at least one thermoelectric couple comprising a sputter deposited thin film p-type thermoelement, a sputter deposited thin film n-type thermoelement positioned adjacent the p-type thermoelement, and an electrically conductive member electrically connecting a first end of the p-type thermoelement with a second end of the n-type thermoelement;

a high-temperature heat pipe connected to a hot connection of the thermoelectric module; and

a low-temperature heat pipe connected to a cold connection of the thermoelectric module.

68. The thermoelectric power source of claim 67, wherein the heat pipes further include a working fluid stored within the heat pipes.

69. The thermoelectric power source of claim 68, wherein the working fluid comprises water, an alcohol, or mixtures thereof.

70. The thermoelectric power source of claim 67, wherein the thermoelectric module comprises multiple thermoelectric couples formed on a flexible substrate.

71. The thermoelectric power source of claim 70, wherein the flexible substrate is wound about a reel.

72. The thermoelectric power source of claim 71, wherein the reel functions as the hot connection and/or the cold connection of the thermoelectric module.

73. The thermoelectric power source of claim 67, wherein the high-temperature heat pipe further includes a coating material on an exterior surface of the heat pipe, the coating material capable of absorbing thermal energy.

74. The thermoelectric power source of claim 73, wherein the coating material on an exterior surface of the heat pipe is capable of absorbing solar radiation.

75. The thermoelectric power source of claim 67, wherein the low-temperature heat pipe further includes insulation on an exterior surface of the heat pipe to reduce transfer of thermal energy from outside the low-temperature heat pipe to inside the low-temperature heat pipe.

76. A TE power source comprising:

a thin film TE module comprising multiple thin film TE p-type and n-type elements formed on a flexible substrate;

a reel having a first end and a second end and about which the flexible substrate is wound;

a low-temperature member thermally connected to the first end of the reel; and

a high-temperature connected to the second end of the reel, wherein the low-temperature and high-temperature members transfer heat to the and from the TE module.

77. The TE power source of claim 76, wherein the low-temperature member and the high-temperature member comprise a first and a second heat pipe, respectively.

78. The TE power source of claim 76, wherein the heat pipes further include a working fluid within the heat pipes.

79. The TE power source of claim 78, wherein the working fluid comprises water, an alcohol, or mixtures thereof.

80. The TE power source of claim 76, wherein the thin film TE p-type and n-type elements comprise sputter deposited Bi_aTe_b where *a* is about 2 and *b* is about 3.

81. The TE power source of claim 78, wherein the working fluid in the heat pipes is re-circulated within the heat pipes.

82. The TE power source of claim 76, wherein the TE power source can generate and maintain a voltage of equal to or greater than about 3.6 V with a temperature difference across the TE module of greater than about 7°C.

83. The TE power source of claim 76, wherein the TE power source can operate in temperature environments of greater than about 100°C.

84. The TE power source of claim 76, wherein the TE power source can operate in temperature environments of less than about -100°C.

85. The TE power source of claim 76, wherein the TE power source can operate in temperature environments of greater than about 250°C.